AVERT

Version 1.0 – April 1998

A Tool for Estimating Intervention Effects on the Reduction of HIV Transmission

Manual prepared by
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CHAPTER 1

THE AVERT PROGRAM

INTRODUCTION

The AVERT program was designed and developed by Family Health International's AIDS Control and Prevention (AIDSCAP) Project, with the support of the United States Agency for International Development (USAID). AVERT offers a means to estimate the impact of prevention interventions, such as increased condom use, improved treatment of sexually transmitted diseases (STDs), or changes in sexual behaviors (e.g., reducing the number of sex partners), on the reduction of HIV transmissions through sexual intercourse over a given time period. The program calculates how many fewer infections there would be in a given time period following an intervention, based typically on a one-year time-frame. The model is built around a formula adapted from MC Weinstein, JD Graham, JE Siegel, and HV Fineberg, "Cost-effectiveness analysis of AIDS prevention programs: concepts, complications, and illustrations" (in *Confronting AIDS: Sexual Behavior and Intravenous Drug Use*, edited by CF Turner, HG Miller, and LE Moses; 1989, pp. 469-499).

The purpose of this design is to provide a relatively simple and useful tool, particularly for users with little experience in modeling. The goal has been to offer a computer program that is easy to use and understand, and that generates rapid estimates of program impacts with a reduced number of input parameters that are more readily available to intervention programs. There has been an increasing demand within the international HIV/AIDS community to access such instruments for the purposes of assisting the ongoing development of interventions and of influencing the direction and speed of policy changes. AVERT represents one such tool.

PROGRAM STRUCTURE

The AVERT program is organized according to a series of screens. Users access a Main Menu screen upon first entry into the program, and from this location a choice can be made to choose to start a new file or open an existing file. Whichever choice is made, the subsequent screen is for data-entry or data-editing. Results can be seen immediately on the next screen, accessed by the <PAGE DOWN> key. The user needs to press <PAGE UP> to return to the data entry screen, from which one can access the Pop-Up menu, activated by function key <F10>, and select the option to print the file or to exit.

THE AVERT MANUAL

Each of the following chapters addresses different aspects of AVERT. The manual is organized according to installation and to data-entry procedures. **We recommend that the user read this manual**

before using AVERT, but this is not a prerequisite to starting this program. After basic use instructions are addressed, a tutorial guides the user both in the use of AVERT and in the type of data appropriate to the program.

Chapter 2 ***Setting Up and Starting***
Contains basic information for the installation of the AVERT program onto your computer.

Chapter 3 ***Main Menu*** *-- The Opening Screen*
Provides information and instructions for the first screen that appears when the program is started. From this vantage, the user can begin a new file, enter an existing file, delete a file, view the probability formula and default values used in the program, and exit the program.

Chapter 4 ***Variables*** *-- The Data Entry Screen*
Provides for the entry of all relevant data into the program. This chapter provides instructions for the entry of the "constant variables" and "intervention variables."

Chapter 5 ***Probable Infections*** *-- The Results Screen*
Displays probable infections among target, partner, and combined populations, and estimated number of infections averted as a result of the intervention. Total number of sex acts is documented, as are cumulative incidence rates for each population and the combined total.

Chapter 6 ***Printing Files*** *-- Getting Hard Copy and Computer Files*
Explains procedures for sending an active file to a printer or to disk.

Chapter 7 ***Exiting AVERT***
Addresses how users can save files, return to *The Data Entry Screen*, or exit the program.

Chapter 8 ***Tutorial*** *-- A Trial Run*
Offers an example of a program evaluation based on actual data from the field.

Chapter 9 ***What's Behind the Model?*** *-- The Formula, the Default Values, and the Nature of the Model*
Illustrates the formula used as the basis of the program and explains which variables are incorporated as well as how. It also contains the range of default values used in program calculations and explains the strengths and weaknesses of AVERT, addressing particularly the applications for which it is designed.

Manual Conventions

< > (angle brackets) surrounding an upper-case word indicates a key on your keyboard. For example,

"Press <ENTER> to select a menu item."

[ ] (square brackets) surrounding upper-case or lower-case words indicate a hierarchical menu selection. The initial word represents a menu header on the Main Menu screen, and words after the "|" (vertical bar) indicate subsequent menu options. For example,

+

"Select [FILE|Open] to edit an existing file."

→ (right arrow) designates a message with suggestions or important comments.

Bold Upper Case letters in this manual indicate text that is to be typed by the user.

INFORMATION AND TECHNICAL ASSISTANCE

For additional information regarding the AVERT program, or if you have questions or suggestions, please contact:

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PROGRAM DEVELOPMENT

AVERT was created through the Evaluation Unit of the AIDSCAP office. Several members of the AIDSCAP/FHI staff and several consultants participated in this effort, producing the current version of the program. Participants included:

Dr. Paul D. Bouey	Dr. Susan Hassig	Ms. Liliana Vivanco
Dr. Gina Dallabetta	Mr. Phil Hughes	Dr. Thomas Rehle
Mr. Steven Forsythe	Dr. Claude Kamenga	Dr. Tobi Saidel
Mr. Eric M. Gaillard	Ms. Lisa Moore	Dr. David Sokal
Dr. Cynthia A. Gomez	Dr. Melinda Moore	Dr. Mike Sweat

Computer programmer:

Mr. Eric M. Gaillard

CHAPTER 2

SETTING UP AND STARTING

MINIMUM PROGRAM REQUIREMENTS

Version 1.0 of AVERT is a stand-alone program designed for use in an IBM-compatible DOS environment. This program was designed on a dBASE IV platform but does not need dBASE IV to function. Your computer requires only DOS 3.1 or higher (or an equivalent operating system) to work. Disk space requirements for the working program are 1.6 MB. Due to the size of this program, the floppy disk distributed with this manual contains a compressed file which must be decompressed onto a hard drive before the program can run. (Instructions are detailed below in the section titled "Installing the Program.") Also note that any files you create when using this program have additional storage requirements above and beyond those associated with the program. The model is public domain software which may be freely copied.

INSTALLING THE PROGRAM

The disk you have received with the AVERT program includes all program files in a compressed (i.e., zipped) format. PKUNZIP.EXE is also included on the disk, allowing you to decompress and transfer files to your hard drive. Before installing AVERT on your computer, make a working copy of the Master Disk and store the original in a safe location. Use the working copy to complete the installation procedures.

Step 1: Make a subdirectory on your DRIVE C: to contain the program files.

Type **MD\[subdirectory name]** (e.g., AVERT)

Step 2: Insert the diskette with the working copy of AVERT in your computer's floppy drive.

Place the disk in Drive A: (or Drive B:).

Step 3: Decompress (unzip) the files on the working diskette into the subdirectory you have created on the hard drive.

Type **A:PKUNZIP A:AVERT C:\AVERT**
(B: may be substituted for A: if you are working off Drive B:.)

Step 4: When copying is complete, remove the working copy of the disk and start the program.

⇨ If you are using Windows 3.1, select the [FILE|Run] option from the Program manager.

Type **A:PKUNZIP A:AVERT C:\AVERT** and choose OK. Create a program icon to activate AVERT.

⇨ If you are using Windows 95, select [Run] from the [Start] menu. Type **A:PKUNZIPA:AVERT C:\AVERT** and choose OK. Copy the program icon to create a shortcut from the Desktop.

TO START THE PROGRAM

For ease of performance you can modify your AUTOEXEC.BAT file to include the name of your AVERT subdirectory name in your PATH command line. Otherwise, switch directories into the program subdirectory:

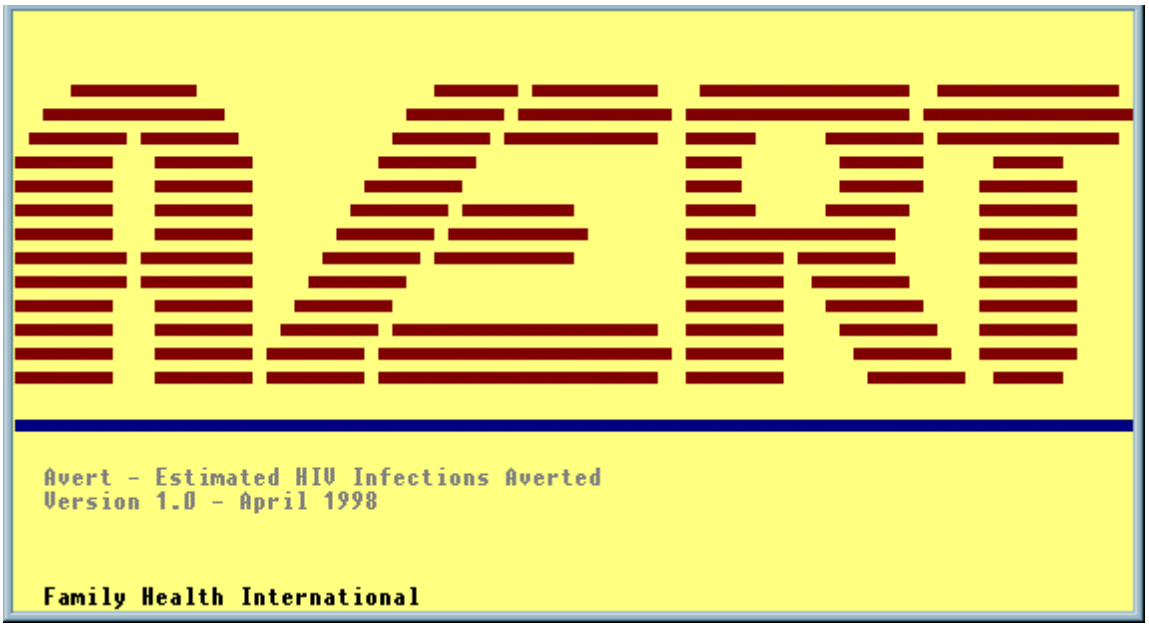
- Type **CD\AVERT**

Once in this directory, or from any directory if your AUTOEXEC.BAT file PATH command includes the AVERT subdirectory,

- Type **AVERT** and the program will begin.

⇨ If you are using Windows 3.1 or Windows 95,[1] click on the program/short-cut icon to activate the program.

A title screen will appear first, followed by an informational screen describing the program and next by a helpful hints screen. Press <ENTER> to move quickly past each of these screens. The fourth screen is the Main Menu. Choose a menu selection, follow instructions, and enter required data.



[1] Windows 3.1 and Windows 95 are registered trademarks of Microsoft Corporation.

PROGRAM USE CONVENTIONS

Conventions followed in the use of this program are consistent with most other software. Note, however, that only a few Functions Keys are activated and that they have specific applications.

Keyboard

Arrow Keys

The arrow keys can be used to move between menu selections or between data-entry fields. Up-Down and Left-Right motions according to arrow key symbols are supported.

ENTER Key

The <ENTER> key is used to select menu options and to signal completed input of data into fields.

ESC Key

The <ESC> key allows the user to return to a higher menu level. For example, if your cursor is on [Open] in the [FILE] menu (i.e., [FILE|Open]), pressing <ESC> will return you to the next higher menu level (i.e., [FILE]).

TAB Key/SHIFT -- TAB Key
The <TAB> key can be used to move in a forward direction between data-entry fields. A<SHIFT>-<TAB> combination permits movement in a reverse direction between data-entry fields.

PAGE UP/PAGE DOWN Keys

Using the <PAGE UP> and <PAGE DOWN> keys permits the user to move between the Variables (Data Entry) and Probable Infections (Results) screens.

Function Keys

<F1> HELP

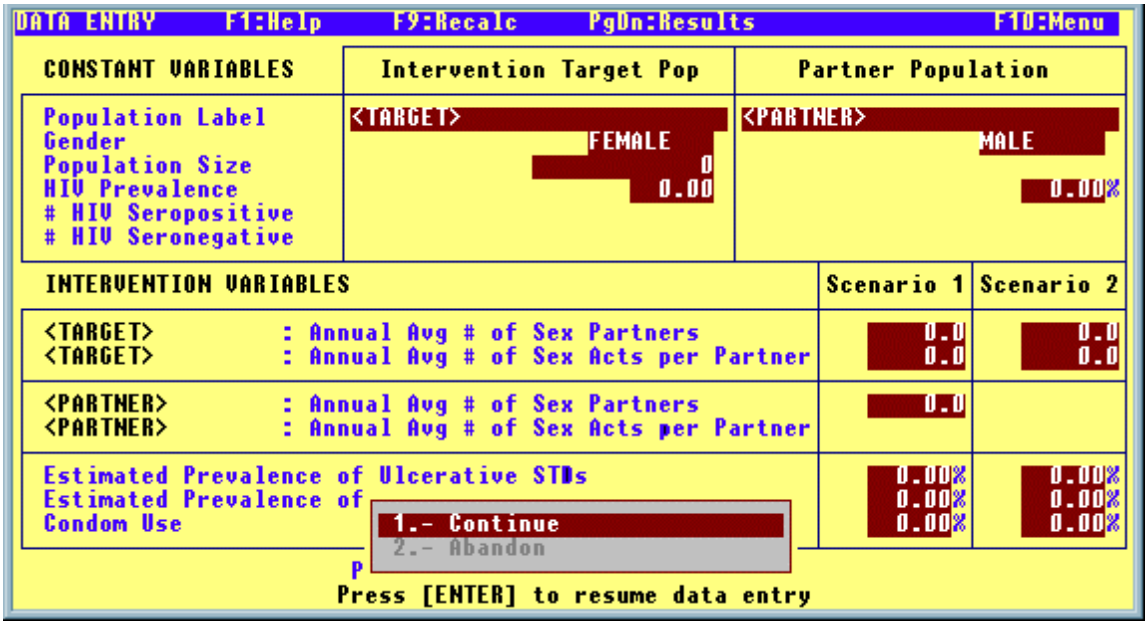
Press <F1> to access information about the field in which the cursor is located. Additional messages are presented at the bottom of the screen to assist the user with specific tasks. These messages respond to the position of the cursor within a screen and to particular menu selections.

<F9>

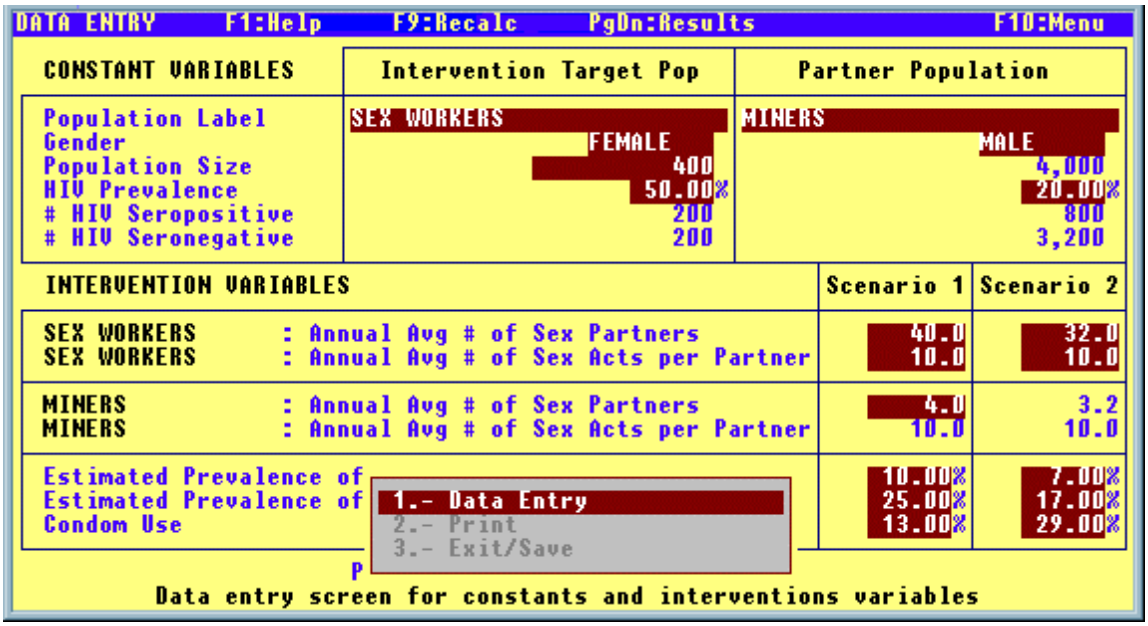
After changing the contents of a field, press <F9> to update the calculations on the screen. If you do not press <F9>, recalculation occurs only after you press <ENTER> in the last data entry field or after you press <PAGE DOWN> key.

<F10> Pop-Up MENU

The first menu appears when the Data Entry or Results screens do not contain information. Selections allow the user to remain in the Date Entry mode or to abandon the procedure to access the Main Menu again.



The second menu permits direct access to three program options after data have been entered. The user can return to the data entry screen, print a document to a printer or computer file, or exit from the program.



Case Sensitivity

AVERT is not case-sensitive. All information will be accepted by the program and all functions executed, regardless of data input in **UPPER CASE** or **lower case** modes.

CHAPTER 3

MAIN MENU

— The Opening Screen

The Main Menu screen is the entry point to AVERT. From this position the user has access to creating new files, editing existing files, deleting files, viewing the program probability formula and default values, and exiting the program. This screen is simple in structure, with only four primary selections.

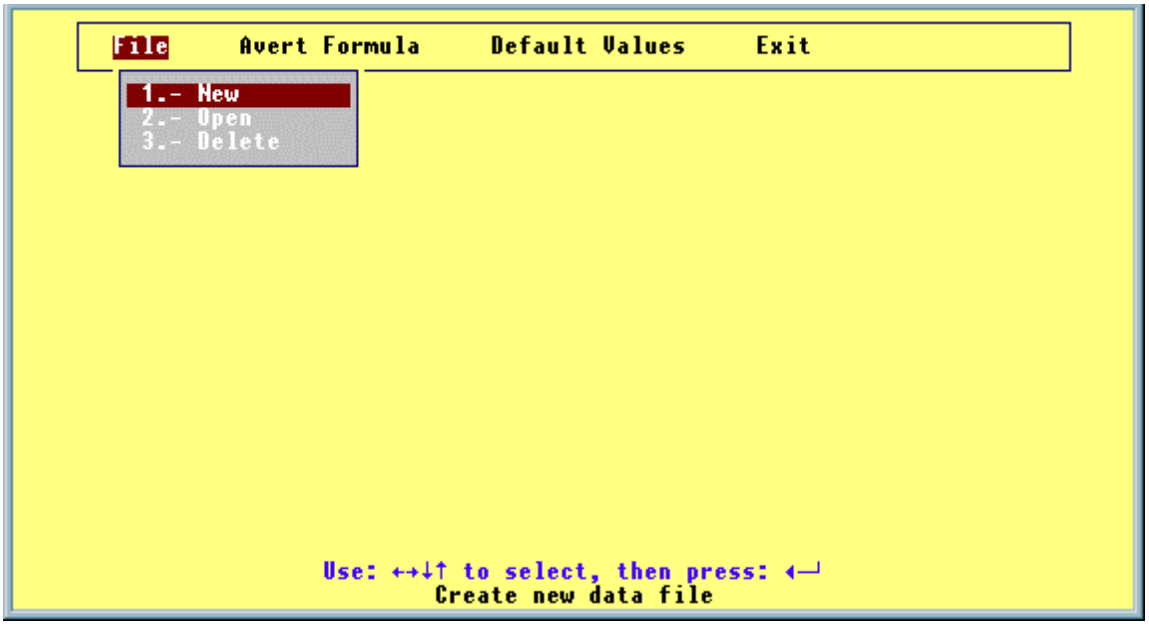
[FILE]

Options offered under [FILE] include

[FILE|New]
[FILE|Open]
[FILE|Delete]

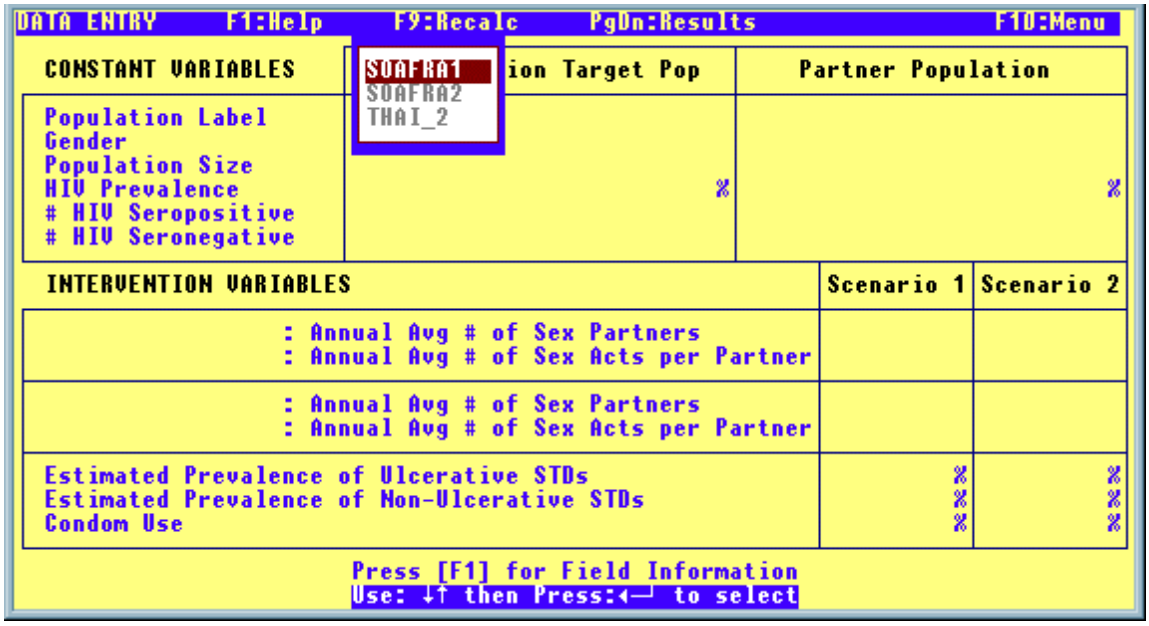
Place the highlighted bar on [FILE]. The menu box with three selections appears, after which you can move the highlighted bar to the option you wish. Press <ENTER>, and the program will proceed to the next screen.

[FILE|New]



This selection accesses a blank template of the data entry screen.

[FILE|Open]



This selection accesses a file list from which the user chooses a file to open. Use the arrow keys to place the highlighted bar on the file name of interest, press <ENTER>, and the initial screen of that file will appear.

→ Once a file has been opened, the user can make any changes desired. Note that if changes are made and the file is saved, those changes will be retained in the archived copy. If you want the original file, in addition to a modified file with different data, replace the original file name when exiting. The new data will be saved under a different file name, and you will have copies of both the original and new information.

[FILE|Delete]

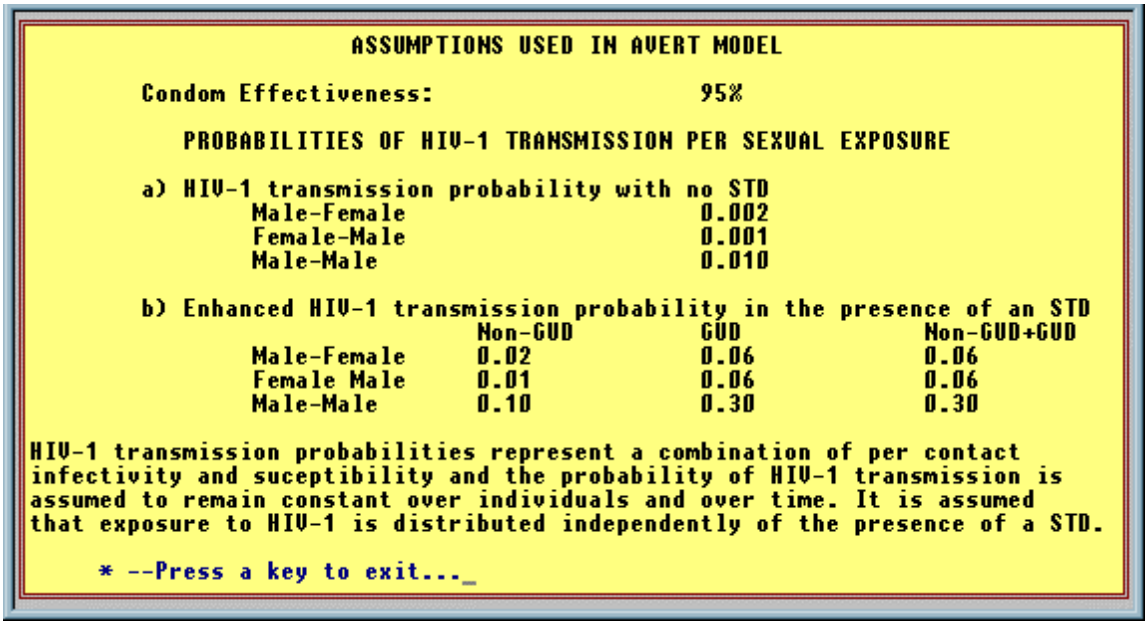
This selection accesses a list from which the user chooses a file to delete. Use the arrow keys to place the highlighted bar on the file name of interest, press <ENTER>, and the data file will be removed.

[FORMULA|Formula]

Move the highlighted bar to [FORMULA] and press <ENTER> to access the probability formula used in the program. The formula itself, as well as definitions of constituent variables, is listed.

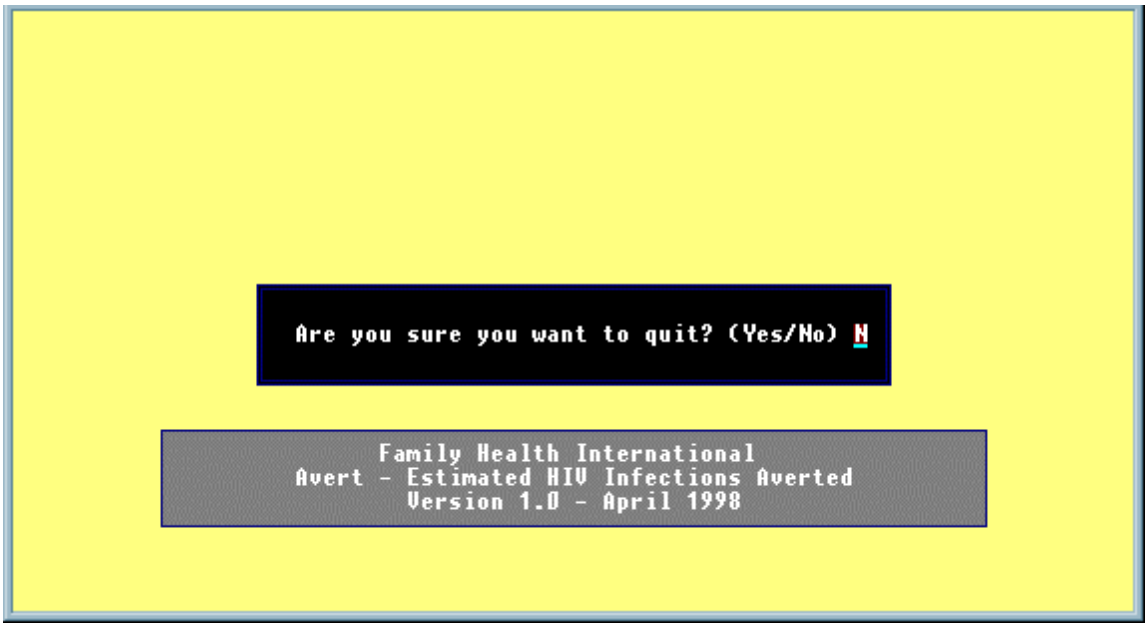
[DEFAULT VALUES|Default Values]

Choosing this selection produces a screen with the default values for HIV-1 transmission probabilities per sexual exposure and condom effectiveness used in the program.



[EXIT|Exit Model]

To access this option, place the highlighted bar on [EXIT] and press <ENTER>. The user is asked to verify the selection to exit the program and has to answer Y (Yes) or N (No) to complete execution. The default value for the verification question is N (No); press <ENTER> to select No and return to the program.



CHAPTER 4

VARIABLES

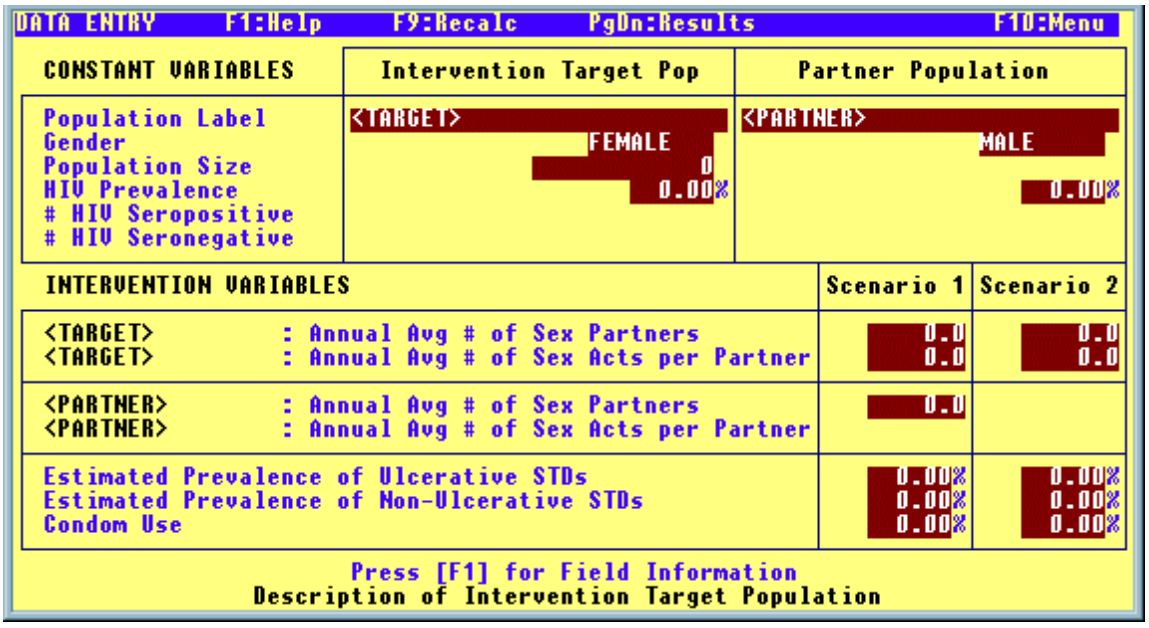
— The Data Entry Screen

In the data entry screen, input variables are entered for both the intervention population and for their partners for both a “pre-intervention” and a “post-intervention” scenario. These are represented on the screen as Scenario # 1 and Scenario # 2, respectively. Detailed descriptions for each input variable follow in this chapter. The sequence of these descriptions mirrors the order in which data are entered on this screen.

This screen is organized into two sections, constant variables and intervention variables. The constant information is located in the upper box, while intervention data are in the lower.

CONSTANT VARIABLES

This portion of the screen allows input of descriptive and constant data for the project. Filling in these parameters is necessary for the successful execution of this program. Access to the Pop-Up Menu for printing and exiting/saving options appears in this screen.



Intervention Target Population

Identify the population that is the target of your intervention. For example, such groups might include factory workers, truck drivers, female or male sex workers, etc. Please choose only one.

Sex Partners of Intervention Target Population

AVERT must be run separately for each type of partner population with which members of the target population might be sexually active. For example, if the target population is male factory workers who have sex with both their regular partners and with female sex workers, the model would have to be run separately to get estimates for each group. It is up to the user to select which type of partner populations are relevant to the intervention.

For this field, please enter the type of sex partners chosen for this scenario.

Gender of Intervention Target Population

Identify the gender of the target population. Your choice is limited to male or female. The following pairings (between intervention and partner populations) are valid:

Female/Male
Male/Female
Male/Male

Note: AVERT does not address female/female pairings.

Gender of Partner Population

Identify the gender of the target population. Your choice is limited to male or female. The following pairings between intervention and partner populations are valid:

Female/Male
Male/Female
Male/Male

Note: AVERT does not address female/female pairings.

Size of Intervention Target Population

Enter your best estimate of the size of the population your intervention program actually reaches.

Note: The size of the partner population is calculated for you by the model. This is necessary to insure that the number of sexual acts by both groups are equal.

Estimated HIV Prevalence in Intervention Target Population

Enter the estimated HIV prevalence for your intervention target population. If these data are not collected by your project, you should resort to best estimates from similar groups in comparable settings.

Note that HIV prevalence is entered only once and is held constant for all calculations related to Scenario # 1 and Scenario # 2.

Estimated HIV Prevalence in Your Selected Partner Population

Enter the estimated HIV prevalence for your partner population. If these data are not collected by your project, you should resort to best estimates from similar groups in comparable settings.

Note that HIV prevalence is entered only once and is held constant for all calculations related to Scenario # 1 and Scenario # 2.

Number of HIV Seropositives and Number of HIV Seronegatives

These figures are calculated from Population Size and HIV Prevalence input. The Seropositive figure is the product of Population Size multiplied by HIV Prevalence, and the Seronegative figure is the difference of Population Size minus the Seropositive value.

INTERVENTION VARIABLES

Scenario # 1 Inputs:

Annual Average Number of Sex Partners of Intervention Target Population

Enter your best estimate of the average number of different individual partners per year (chosen only from the selected partner population) with which the members of your intervention target population have sexual contact in Scenario # 1.

For example, if the intervention population is male factory workers and the selected partner population is female sex workers, you would enter the number of different sex workers with whom each man, on average, has sex during a year's time.

Average Number of Sex Acts Per Year for Intervention Target Population

This figure represents the overall number of times each member of the target population has sex with his/her partner population contacts, on average, in a year's time in Scenario # 1.

For example, if the intervention population is male factory workers and the selected partner population is female sex workers, you would enter the number of sex acts that each man has, on average, with each individual sex worker during a year's time.

Annual Average Number of Sex Partners for the Selected Partner Population

Enter your best estimate of the average number of different individual partners with whom each member of the partner population has sexual contact in a year's time (chosen only from the intervention population) in Scenario # 1.

For example, if the intervention population is male factory workers and the selected partner population is female sex workers, you would enter the number of different factory workers with whom each sex worker, on average, has sex during a year's time.

Note: The annual average number of sex acts per partner for the selected partner population is calculated by the program. (It is obvious that the number of sex acts per partner must be identical for each of the two individuals having sex with each other.)

Estimated Prevalence of Ulcerative STDs (e.g., syphilis, chanchroid, herpes)

The STD prevalence variable is separated into two different categories: STDs that cause genital ulcer disease (e.g., syphilis, chanchroid, herpes) and STDs that are non-ulcerative (e.g., gonorrhea, chlamydial infection, trichomoniasis). Note that STD prevalence estimates are used as a proxy for the proportion of HIV-associated sex acts that occur in the presence of an STD during the time-frame of Scenario # 1. *Only one set of values is entered into the AVERT model and applied to the entire study population.* If the STD prevalence levels are thought to be different for the target and partner populations, it is recommended that the higher of the two values be used as the input parameter.

For this field please enter the estimated prevalence of ulcerative STDs. For example, if the intervention population is male factory workers with a prevalence of 1% ulcerative STDs, and the partner population is female sex workers with a prevalence of 4% ulcerative STDs, it is recommended for this scenario that you enter 4%.

Estimated Prevalence of Non-ulcerative STDs (e.g., gonorrhea, chlamydial infection, trichomoniasis)

The STD prevalence variable is separated into two different categories: STDs that cause genital ulcer disease (e.g., syphilis, chanchroid, herpes) and STDs that are non-ulcerative (e.g., gonorrhea, chlamydial infection, trichomoniasis). Note that STD prevalence estimates are used as a proxy for the proportion of HIV-associated sex acts that occur in the presence of an STD during the time-frame of Scenario #1. *Only one set of values is entered into the AVERT model and applied to the entire study population.* If the STD prevalence levels are thought to be different for the target and partner populations, it is recommended that the higher of the two values be used as the input parameter.

For this field, please enter the estimated prevalence of non-ulcerative STDs. For example, if the intervention population is male factory workers with a prevalence of 5% non-ulcerative STDs, and the partner population is female sex workers with a prevalence of 25% non-ulcerative STDs, it is recommended for this scenario that you enter 25%.

Condom Use

This variable represents the proportion of sex acts that are protected with a condom for Scenario # 1.

Data on different self-reported behaviors might be used to estimate a value for this parameter, depending on what is available from behavioral surveys. For example, if the appropriate data were available, one could base this proportion on the actual number of sex acts with specific types of partners, where a condom is used. In the absence of this kind of data, one might start with the proportion of people in the study population who report using condoms 100% of the time with the partner population in question, and then augment that number with a portion of those who report using condoms some of the time. In either instance, this variable is assumed to be spread randomly across all population segments.

Scenario # 2 Inputs:

Annual Average Number of Sex Partners of Intervention Target Population

Enter your best estimate of the average number of different individual partners per year (chosen only from the selected partner population) with which the members of your intervention target population have sexual contact in Scenario # 2.

For example, if the intervention population is male factory workers and the selected partner population is female sex workers, you would enter the number of different sex workers with whom each man, on average, has sex during a year's time.

Average Number of Sex Acts Per Year for Intervention Target Population

This figure represents the overall number of times each member of the target population has sex with his/her partner population contacts, on average, in a year's time in Scenario # 2.

For example, if the intervention population is male factory workers and the selected partner population is female sex workers, you would enter the number of sex acts that each man has, on average, with each individual sex worker during a year's time.

Note: The annual average number of sex partners for the selected partner population is calculated by the program (determined by the previous two inputs for the intervention target population and the partner population size which is held constant in both scenarios). The average annual number of sex acts per partner for the selected partner population is again calculated for you by the program (see previous note for Scenario # 1 Inputs).

Estimated Prevalence of Ulcerative STDs (e.g., syphilis, chanchroid, herpes)

The STD prevalence variable is separated into two different categories: STDs that cause genital ulcer disease (e.g., syphilis, chanchroid, herpes) and STDs that are non-ulcerative (e.g., gonorrhea, chlamydial infection, trichomoniasis). Note that STD prevalence estimates are used as a proxy for the proportion of HIV-associated sex acts that occur in the presence of an STD during the time-frame of Scenario # 2. *Only one set of values is entered into the AVERT model and applied to the entire study population.* If the STD prevalence levels are thought to be different for the target and partner populations, it is recommended that the higher of the two values be used as the input parameter.

For this field please enter the actual or projected effect of the intervention on the reduction of ulcerative STDs (if you think your intervention has been instrumental in reducing ulcerative STDs). This is done by entering the estimated lower prevalence of ulcerative STDs in this field.

Estimated Prevalence of Non-ulcerative STDs (e.g., gonorrhea, chlamydial infection, trichomoniasis)

The STD prevalence variable is separated into two different categories: STDs that cause genital ulcer disease (e.g., syphilis, chanchroid, herpes) and STDs that are non-ulcerative (e.g., gonorrhea, chlamydial infection, trichomoniasis). Note that STD prevalence estimates are used as a proxy for the proportion of HIV-associated sex acts that occur in the presence of an STD during the time-frame of Scenario # 1. *Only one set of values is entered into the AVERT model and applied to the entire study population.* If the STD prevalence levels are thought to be different for the target and partner populations, it is recommended that the higher of the two values be used as the input parameter.

For this field please enter the actual or projected effect of the intervention on the reduction of non-ulcerative STDs (if you think your intervention has been instrumental in reducing non-ulcerative STDs). This is done by entering the estimated lower prevalence of non-ulcerative STDs in this field.

Condom Use

This variable represents the proportion of sex acts that are protected with a condom in Scenario # 2. For this field please enter the actual or projected effect of the intervention on the increased use of condoms (if you think your intervention has been instrumental in increasing condom use). This is done by entering the estimated higher condom use rate in this field.

Data on different self-reported behaviors might be used to estimate a value for this parameter, depending on what is available from behavioral surveys. For example, if the appropriate data were available, one could base this proportion on the actual number of sex acts with specific types of partners, where a condom is used. In the absence of these kinds of data, one might start with the proportion of people in the study population who report using condoms 100% of the time with the partner population in question, and then augment that number with a portion of those who report using condoms some of the time. In either instance, this variable is assumed to be spread randomly across all population segments.

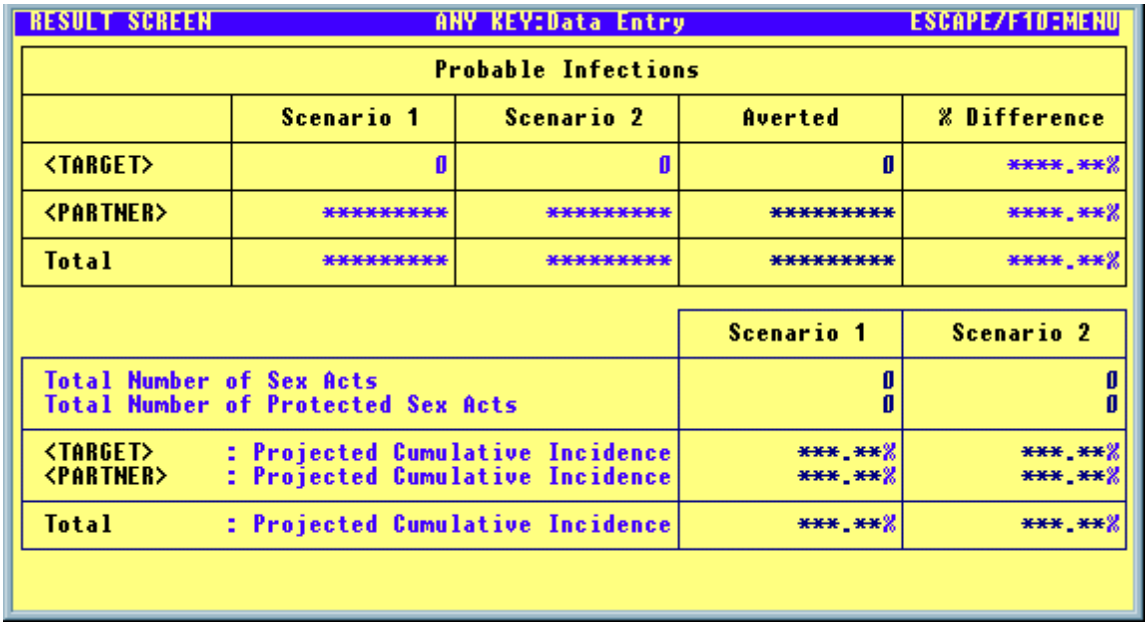
CHAPTER 5

PROBABLE INFECTIONS

— The Results Screen

PROBABLE INFECTIONS

The Probable Infections table contains the principal results of the AVERT program. Values found in these cells are the measures of intervention effects. Data on this screen are organized into two main tables. In the first section are calculation results depicting probable infections by population and by scenario. The estimated number of averted infections for each group is presented, and a corresponding "percent difference" is calculated. In the second section, total number of sex acts and cumulative incidence values are provided for both scenarios.



RESULT SCREEN — ANY KEY:Data Entry — ESCAPE/F10:MENU

Probable Infections

	Scenario 1	Scenario 2	Averted	% Difference
<TARGET>	0	0	0	****.**%
<PARTNER>	**********	**********	**********	****.**%
Total	**********	**********	**********	****.**%

	Scenario 1	Scenario 2
Total Number of Sex Acts	0	0
Total Number of Protected Sex Acts	0	0
<TARGET> : Projected Cumulative Incidence	***.**%	***.**%
<PARTNER> : Projected Cumulative Incidence	***.**%	***.**%
Total : Projected Cumulative Incidence	***.**%	***.**%

INFECTIONS

Scenario # 1

These data represent the results of the application of the Scenario # 1 probability calculation to the susceptible populations of interest (i.e., the HIV Seronegative members of the target and partner populations). Figures are presented for both the target and partner populations, and for the combined total.

Scenario # 2

These data represent the results of the application of the Scenario # 2 probability calculation to the susceptible populations of interest (i.e., the HIV Seronegative members of the target and partner populations). Figures are presented for both the target and partner populations, and for the combined total.

Averted

The estimated number of averted infections is the result of subtracting Scenario # 2 data from Scenario # 1. Values for the target, partner, and combined populations are indicated.

Percent Difference

The Percent Difference figure represents the percent change in averted infections from Scenario # 1 to Scenario # 2. These percentages are calculated as the quotient of Scenario # 1 minus Scenario # 2 infections divided by Scenario # 1 infections, and that result multiplied by 100.

SEX ACTS AND HIV CUMULATIVE INCIDENCE

Sex Acts

The total number of sex acts is calculated as the product of the size of the target population multiplied by their average number of sex partners multiplied by their average number of sex acts per partner. This calculation is performed for both Scenario # 1 and Scenario # 2.

Cumulative Incidence

These figures are calculated as the quotients of the number of probable infections divided by the number of susceptible individuals, and multiplied by 100. Figures are presented for the target, partner, and combined populations.

CHAPTER 6

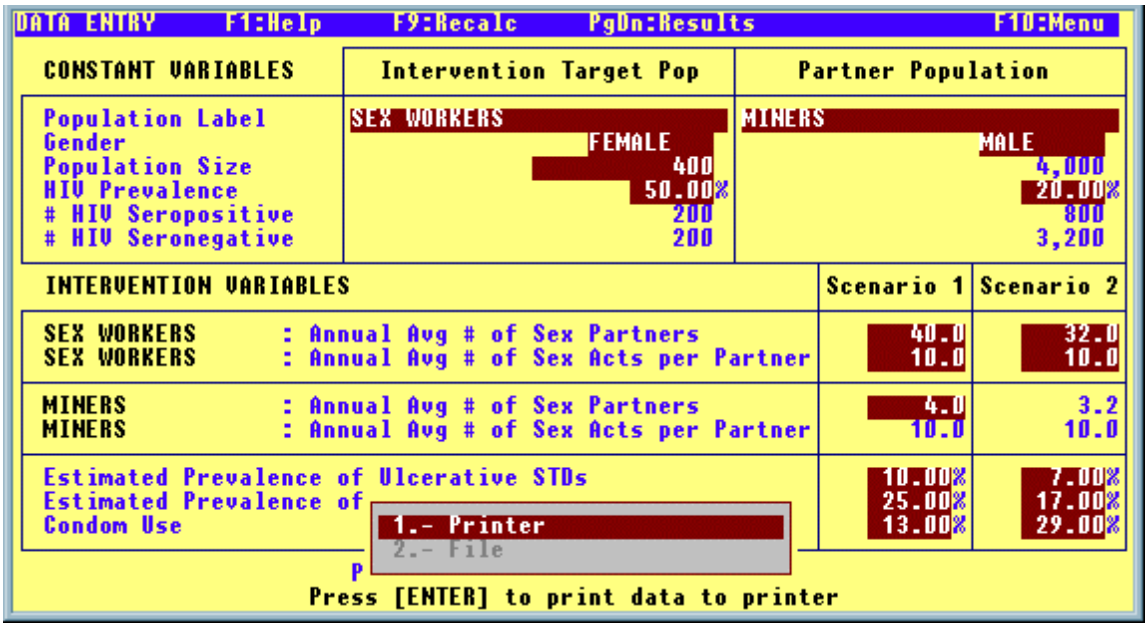
PRINTING FILES

— Getting Hard Copy and Computer Files

Print options are accessed through the Pop-Up Menu (press function key <F10>).

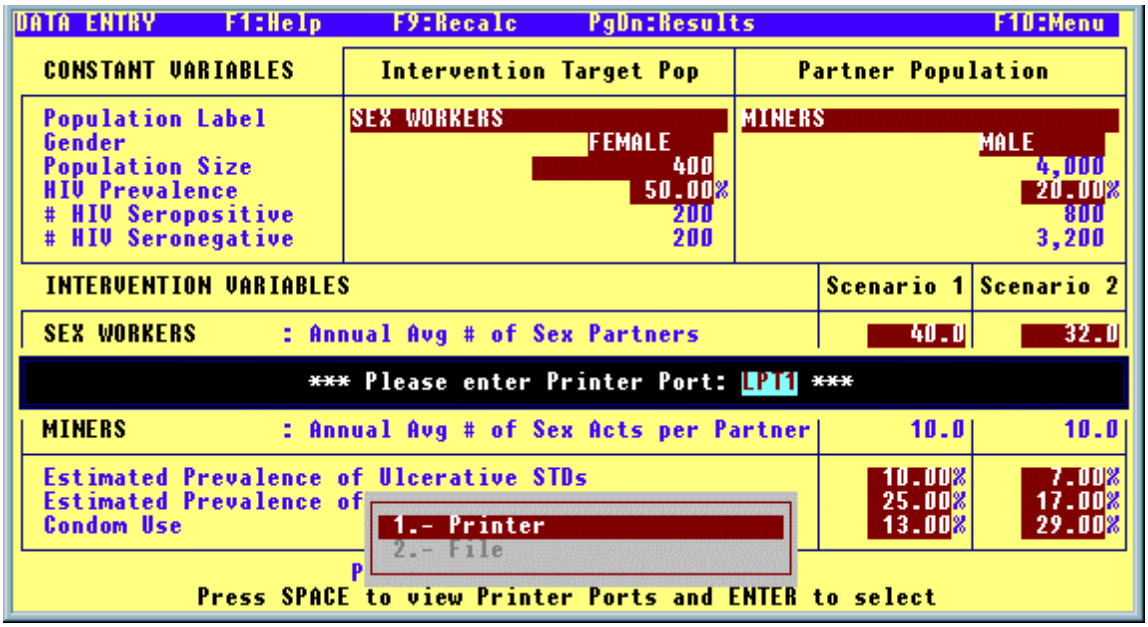
PRINT

Once the Pop-Up Menu has been activated, use the arrow keys to move the highlighted bar to position *2. - Print* and press <ENTER>. Two options are given.



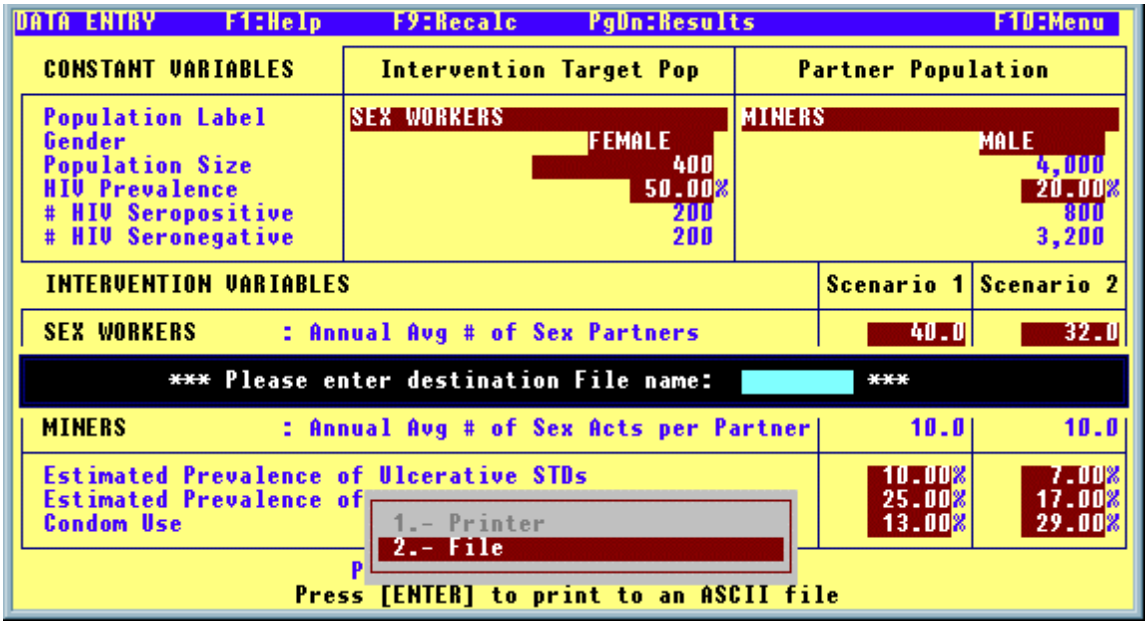
Printer

Move the highlighted bar to this position to print hard copy of the active file. Press <ENTER> and choose the printer port through which data will be sent. The default port selection is LPT1, but when you press <SPACE> a complete list of ports is presented. Use the arrow keys to move the highlighted bar to the port you wish to activate and press <ENTER>. Press <ENTER> again and the file will be sent to the printer.



File

Move the highlighted bar to this position to send a copy of the active file to disk. Press<ENTER> and you are asked to provide a file name. Type a name, followed by pressing <ENTER>. If a file of the same name exists already, you will be notified of that conflict and provided the opportunity to change the name entered or to overwrite the old file. This a text file for printing or text-editor viewing purposes only; the file cannot be accessed by AVERT to re-display the data.


DATA ENTRY F1:Help F9:Recalc PgDn:Results F10:Menu
CONSTANT VARIABLES
Intervention Target Pop
Partner Population
Population Label
Gender
Population Size
HIV Prevalence
HIV Seropositive
HIV Seronegative
SEX WORKERS
FEMALE
400
50.00%
200
200
MINERS
MALE
4,000
20.00%
800
3,200
INTERVENTION VARIABLES
Scenario 1
Scenario 2
SEX WORKERS : Annual Avg # of Sex Partners
40.0
32.0
*** Please enter destination File name: ***
MINERS : Annual Avg # of Sex Acts per Partner
10.0
10.0
Estimated Prevalence of Ulcerative STDs
Estimated Prevalence of
Condom Use
10.00%
25.00%
13.00%
7.00%
17.00%
29.00%
1.- Printer
2.- File
Press [ENTER] to print to an ASCII file

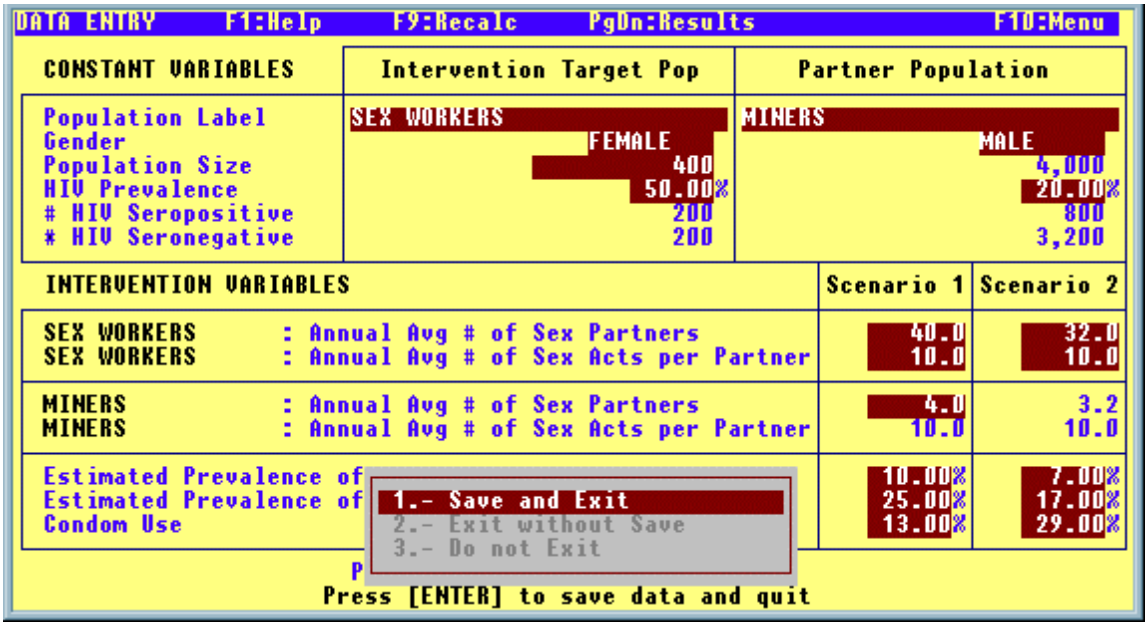
CHAPTER 7

EXITING AVERT

Exit options are accessed through the Pop-Up Menu (press function key <F10>).

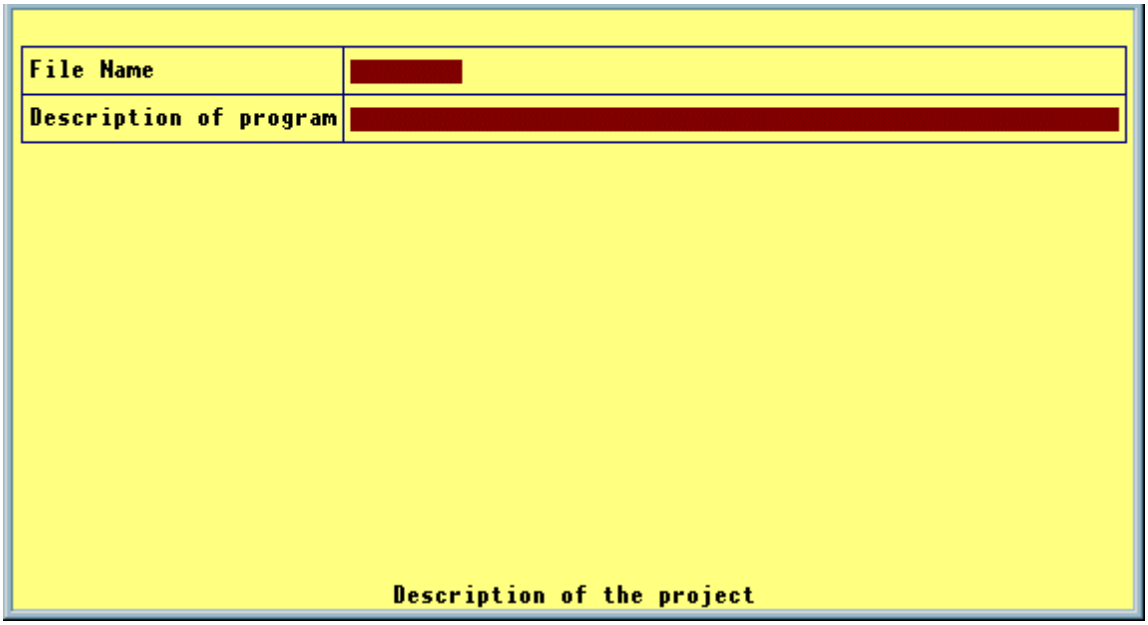
EXIT

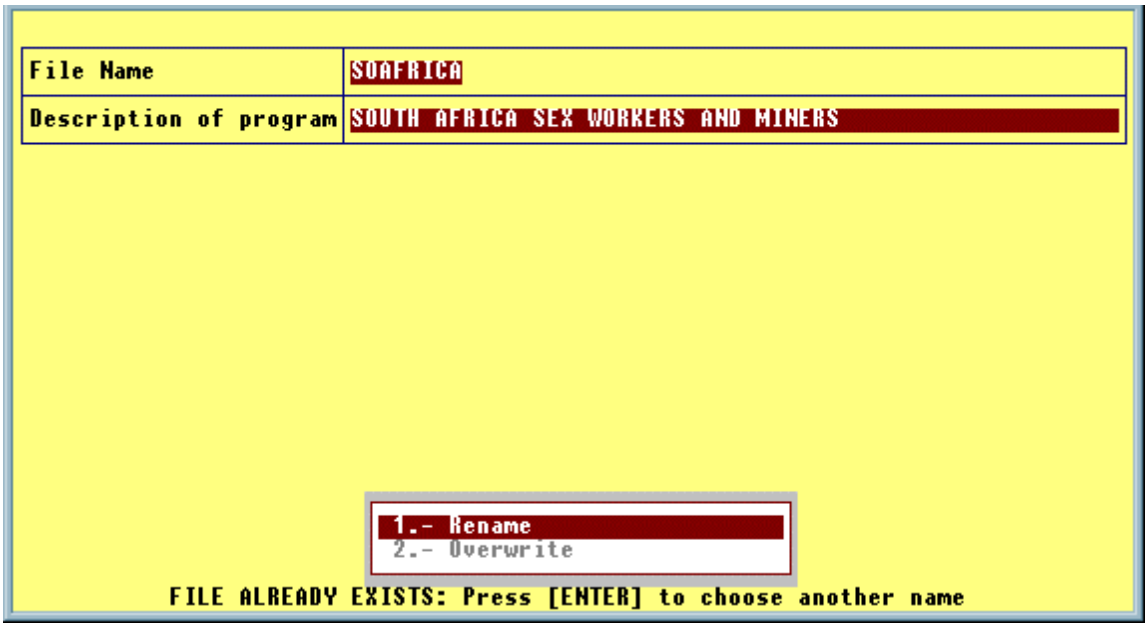
Once the Pop-Up Menu has been activated, use the arrow keys to move the highlighted bar to position *3.- Exit/Save* and press <ENTER>. Three options are given.



Save and Exit

Selecting this option permits the user to save final results from calculations. The save function requires the user to input a file name and a one-line description of the program file. If a file with the same name already exists, a Pop-Up Menu notifies the user of the conflict and offers the opportunity to rename the new version or to overwrite the previously saved version of the file. Once this function is completed, the user is returned to the MAIN MENU screen.





Exit Without Save

This option leaves the current file without preserving any of the current results in a file. The user is returned to the MAIN MENU screen.

Do Not Exit

Invoking this selection permits the user to return to the working screen without saving or exiting a file. No data or calculations are lost in this process. Pressing the <ESC> produces the same results.

CHAPTER 8

TUTORIAL
— A Trial Run

The following tutorial is based on data obtained from one of the first pilot studies of targeted periodic presumptive STD treatment conducted in the developing world. Such treatment has been proposed as an option for reducing STDs in groups at high risk of infection. This focus applies particularly to high-risk women, who often experience no STD symptoms and who may not seek treatment otherwise. The study protocol offered free monthly examinations, treatment, and counseling, combined with community-based peer education on STD/HIV prevention. This program targeted women who trade in sex and other women at high risk of STDs in a South African mining community; the mining employees are a migrant labor force, and they live far away from their families for much of the year. All of the women who used the services were treated with a single-dose antibiotic for the most prevalent STDs in the area. Study results showed that this approach was effective, with substantial decreases in STD prevalence among the women using the service and their miner partners after just nine months of intervention.

THE DATA

For the analysis of this study, we constructed scenarios based on reported behaviors and STD test results. We assumed that the 400 women who used the STD treatment and counseling services regularly had had sexual contact with 4,000 of the 10,000 miners living in the nearby hostels. HIV prevalences were estimated at 50% for the women and 20% for the men.

TABLE 1.	**Target Population** *Female sex workers*	**Partner Population** *Male miners*
Population	400	4,000
Estimated HIV prevalence	50.00%	20.00%

Data for Scenario # 1 included estimates of 40 average annual partners for the women, and an average annual of 10 sex acts with each of those partners. Among the men, the average annual number of partners was estimated to be four, while the average annual number of sex acts with each of these partners was 10. (It is obvious that the number of sex acts per partner must be identical for each of the two individuals having sex with each other.) STD prevalences included genital ulcer disease (GUD) at 10% and non-ulcerative STDs (non-GUD) at 25%. Population condom use was estimated at 13%.

TABLE 2.	**Scenario 1**
Average annual partners -- sex workers	40
Average annual contacts per partner -- sex workers	10
Average annual partners -- miners	4
Average annual contacts per partner -- miners	10[a]
GUD prevalence	10.00%
Non-GUD prevalence	25.00%
Condom use	13.00%

[a] This figure is calculated by the program.

After nine months of intervention, it was estimated that the overall prevalence of genital ulcer disease (GUD) had dropped from 10 to 7% and non-ulcerative STD rates had fallen from 25 to 17%. A 20% reduction in the average number of clients from the miner population from 40 to 32 was observed, and reported condom use by the clients increased from 13 to 29%.

TABLE 3.	**Scenario 2**
Average annual partners -- sex workers	32
Average annual contacts per partner -- sex workers	10
Average annual partners -- miners	3.2[a]
Average annual contacts per partner -- miners	10[a]
GUD prevalence	7.00%
Non-GUD prevalence	17.00%
Condom use	29.00%

[a] This figure is calculated by the program.

EVALUATING DATA WITH AVERT

To obtain estimates of probable averted infections due to this targeted intervention, start the AVERT program.

1. Press <ENTER> three times to access the Main Menu screen.

2. Place the highlighted bar on [FILE|New]. Press <ENTER>.

3. The cursor starts in the Target Population label cell, in which you should type:

SEX WORKERS

Continue hitting the space bar until the remaining letters of <TARGET> are removed. Press <ENTER>.

4. The cursor moves automatically to the Partner Population label cell, in which you should type the word:

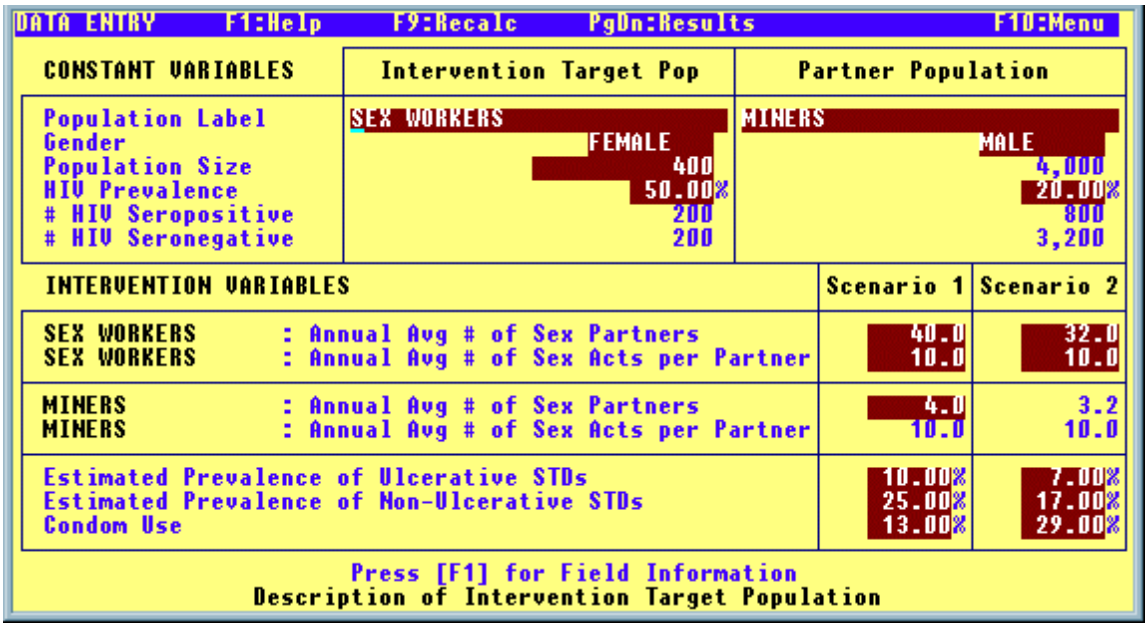
MINERS

Continue hitting the space bar until the remaining letters of <PARTNERS> are removed. Press <ENTER>.

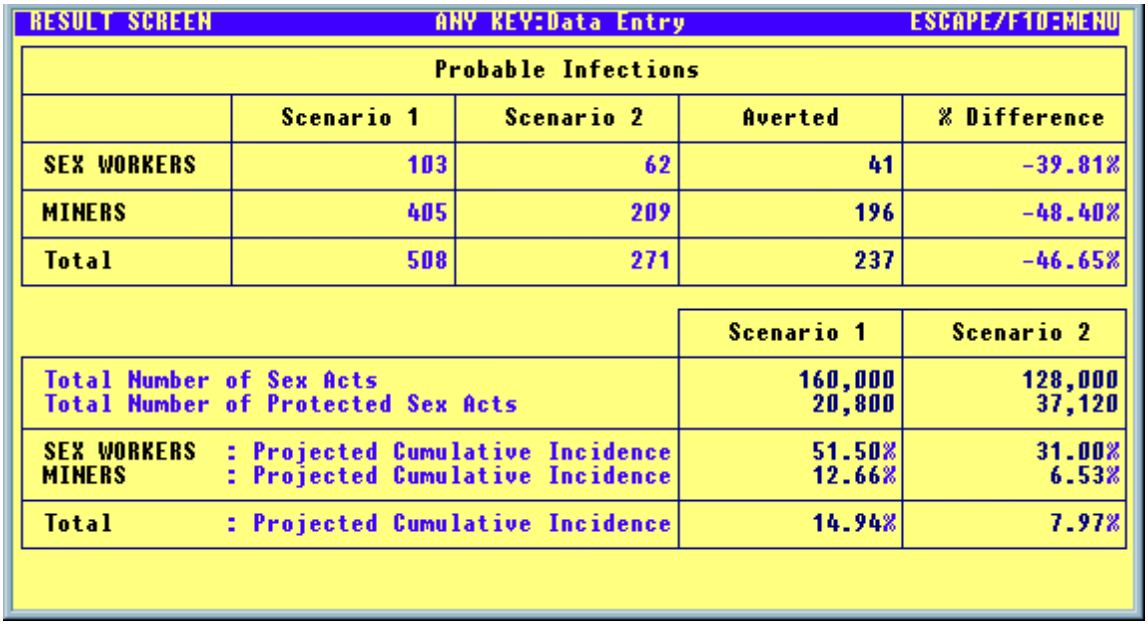
5. The cursor moves to the Target *Gender* cell. Select female by pressing [ENTER]. The cursor then moves to the Partner *Gender*. Select Male by pressing <ENTER>.
(For other scenarios you may change gender by pressing the <SPACE> bar).

6. Enter the number 400 as the Target *Population* size, press <ENTER>. Enter HIV prevalence values for both Target and Partner cells (50% and 20%, respectively, for the target and the partner populations).

7. The cursor will move to the *Annual Avg # of Sex Partners: Sex Workers* cell for Scenario # 1. Enter the number 40 and continue entering data as documented in Table 2 above. Continue entering data for Scenario 2 as illustrated in Table 3.



8. Upon completion of data entry, press <PAGE DOWN>. This action will change the view to the *Result* screen. The number of infections for Scenario # 1 and Scenario # 2 are presented, in addition to the estimated number of averted infections. Changes documented between Scenario # 1 and the intervention consequences of Scenario # 2 resulted in a total of 237 probable averted infections, based on a one-year time-frame.



RESULT SCREEN — ANY KEY:Data Entry — ESCAPE/F10:MENU

Probable Infections

	Scenario 1	Scenario 2	Averted	% Difference
SEX WORKERS	103	62	41	-39.81%
MINERS	405	209	196	-48.40%
Total	508	271	237	-46.65%

	Scenario 1	Scenario 2
Total Number of Sex Acts	160,000	128,000
Total Number of Protected Sex Acts	20,800	37,120
SEX WORKERS : Projected Cumulative Incidence	51.50%	31.00%
MINERS : Projected Cumulative Incidence	12.66%	6.53%
Total : Projected Cumulative Incidence	14.94%	7.97%

These data describe the current status of the intervention program. For future projections, one can enter data in accordance with anticipated changes resulting from ongoing intervention activities. Such an exercise is very useful when working with planning, policy, or funding agencies.

USING AVERT FOR PROJECTIONS

The AVERT model is a very useful tool in the design or planning phase of a prevention program, where implementing organizations or individuals can compare the potential effects of different intervention strategies. If project designers have in mind a specific change in HIV incidence rates, the model's outputs can be used to estimate the amount of behavior change and/or improved STD case management needed to achieve that change in incidence. Conversely, if a particular level of behavior change or STD treatment coverage is envisioned, the designers can see, by incorporating the theoretical numbers into the model, the amount of change in HIV incidence that will result.

Consider an additional time-frame of two to three years, during which time the intervention might be expected to achieve a new set of goals. The diminished number of commercial sex acts is maintained, condom use increases to 50%, and STD infection rates are reduced by 80% relative to baseline levels (from 10% to 2% for ulcerative STDs (GUD) and from 25% to 5% for non-ulcerative STDs [Non-GUD]).

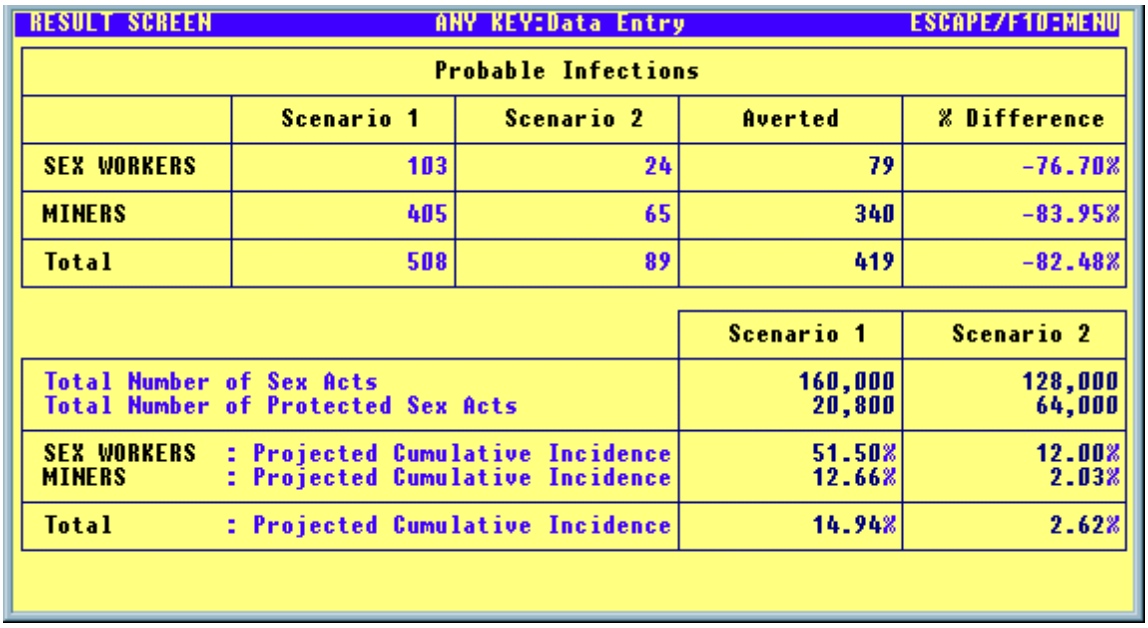
TABLE 4.	**Scenario 3**
Average annual partners -- sex workers	32
Average annual contacts per partner -- sex workers	10
Average annual partners -- miners	3.2[a]
Average annual contacts per partner -- miners	10[a]
GUD prevalence	2.00%
Non-GUD prevalence	5.00%
Condom use	50.00%

[a] This figure is calculated by the program.

1. Press <PAGE UP> to return to the *Variables - Data Entry* screen. Alternatively, press <F10> to access the Pop-Up Menu.

2. Use the arrow or <TAB> keys to move the cursor to the Scenario # 2 column. Replace this information, using Table 4 information as the source of data.

3. Press <PAGE DOWN> to change the view to the *Result* screen.



RESULT SCREEN — ANY KEY:Data Entry — ESCAPE/F10:MENU

Probable Infections

	Scenario 1	Scenario 2	Averted	% Difference
SEX WORKERS	103	24	79	-76.70%
MINERS	405	65	340	-83.95%
Total	508	89	419	-82.48%

	Scenario 1	Scenario 2
Total Number of Sex Acts	160,000	128,000
Total Number of Protected Sex Acts	20,800	64,000
SEX WORKERS : Projected Cumulative Incidence	51.50%	12.00%
MINERS : Projected Cumulative Incidence	12.66%	2.03%
Total : Projected Cumulative Incidence	14.94%	2.62%

These new figures (again calculated for a one-year time-frame as in the example above)demonstrate a much more dramatic change in incidence, with a reduction of 419 probable infections between those from original conditions and those associated with achievement of intervention goals. Incidence rates, too, show significant changes.

CHAPTER 9

WHAT'S BEHIND THE MODEL?

— The Formula, the Default Values, and the Nature of the Model

This chapter includes three sections, all of which pertain to the structure and background features of AVERT. Reviewing this section of the manual will provide the user with a more complete understanding of the model, in addition to its appropriate application.

THE FORMULA

The mathematical foundation underlying the AVERT model is a derivation of a probability formula presented by Weinstein et al. [1]. The structure of the model is based on the risk of an individual becoming infected through sexual acts with a partner drawn randomly from a population with a given prevalence of HIV infection. AVERT takes this model one step further and multiplies this probability by the number of susceptible individuals in the "at-risk" population, obtaining an estimate of new infections. AVERT invokes this equation twice in order to provide estimates for each of the participating sex partner populations. For example, under a given set of conditions, an estimate is calculated for the target population of commercial sex workers, and another is calculated for their client partners. Model estimates are usually based on a one-year time-frame.

The implementation of the basic model in AVERT requires seven different variables: HIV prevalence among sexual partners, *p*; average number of sexual partners, *m*; average number of sexual acts with a given partner, *n*; proportion of sexual encounters employing condoms, *f* ; efficacy of condoms, *e;* prevalence of STDs in population, w_i ; and HIV transmissibility, r_{gi}. The cumulative probability equation is:

$$P = 1 - \left\{ p \sum_{i=1}^{4} w_i \left[1 - r_{gi} \left(1 - fe \right) \right]^n + \left(1 - p \right) \right\}^m$$

The first sequence of calculations yields a probability of risk to the target population (population A) by means of having sex with members of the partner population (population B):

$$P_{A\leftarrow B} = 1 - \left\{ p_B \sum_{i=1}^{4} w_i \left[1 - r_{A\leftarrow Bi} \left(1 - fe \right) \right]^{n_A} + \left(1 - p_B \right) \right\}^{m_A}$$

This risk to A derives from several behavioral characteristics of A, and from HIV prevalence of and HIV transmissibility from B. The result is multiplied by the number of susceptible individuals in A to yield an estimate of new infections within A. The second set of calculations follows an identical procedure but measures risk to B on the basis of B behavioral characteristics and HIV prevalence of and transmissibility from A.

$$P_{B\leftarrow A} = 1 - \left\{ p_A \sum_{i=1}^{4} w_i \left[1 - r_{B\leftarrow Ai} \left(1 - fe \right) \right]^{n_B} + \left(1 - p_A \right) \right\}^{m_B}$$

This result is multiplied by the number of susceptible individuals in B, generating an estimate of new infections within this group.

Once cumulative probabilities are calculated for each study population ($P_{A\neg B}$ and $P_{B\neg A}$), those values are multiplied by the corresponding HIV-negative populations. These procedures produce estimates of new HIV infections within each group, and the total comprises the estimate for the target and partner populations combined.

HIV Prevalence -- *p*. The HIV prevalence variable incorporates two separate values. When measuring risk to the target population (A), the HIV prevalence of their partner population (B) is used. Calculations are performed independently of those measuring risk to the partners (B); in the latter, the HIV prevalence of the target population (A) is used and calculations are treated independently. HIV prevalence works as a constant variable in all circumstances.

Average Number of Sexual Partners -- *m*. One value is given for the target population (A) and a second for the partner population (B). These numbers can vary considerably between the (A) and (B) populations. The size of the target and partner population is held constant for all calculations when two scenarios are compared.

Average Number of Sexual Acts with Each Individual -- *n*. A figure is required for the target population (A)--the overall average number of times each target (A) member has sex with each of her/his partners (B)--and for the partner population (B)--the overall average number of times each partner (B) member has sex with each of his/her target population (A) contacts.

Condom Use -- *f*. This variable represents the proportion of sex acts that are protected with a condom. Data on different self-reported behaviors might be used to estimate a value for this parameter, depending on what is available from behavioral surveys. This variable is assumed to be spread randomly across all population segments.

Condom Efficacy -- *e*. The value assigned to this variable reflects the effectiveness rate of condoms in preventing the transmission of HIV during a single sexual exposure. Based on related research [2-4], the default value found in AVERT is 95% and is used as a constant in all calculations.

Prevalence of STDs -- w_i. The STD prevalence variable is separated into four different categories (represented by the subscript *i*): STDs which cause genital ulcer disease (GUD), non-ulcerative STDs (Non-GUD), a combination of ulcerative and non-ulcerative STDs (GUD + Non-GUD), and no STDs. Only one set of values is entered into the AVERT model and applied to the entire study population. If the STD prevalence levels are thought to be different for the target (A) and partner populations (B), it is recommended that the higher of the two values be used as the input parameter for the model. Data entry is restricted to two values: ulcerative (GUD) and non-ulcerative (Non-GUD) STD prevalence. These values are multiplied by each other to yield the prevalence for the combination category (GUD + Non-GUD), and that value is subtracted from each of the entries to provide the adjusted GUD and Non-GUD prevalences. All three of these values are added together and subtracted from 1 to obtain the no-STD proportion. Note that STD prevalence estimates are used as a proxy for the proportion of HIV-associated sex acts that occur in the presence of an STD. Each set of calculations--risk to target (A) and risk to partners (B)--is stratified into each of the four STD groups for the central component of the equation associated with the summation sign. Results from these calculations are summarized and the final steps in the formula completed.

HIV Transmissibility -- r_{gi}. Values for HIV infectivity are dependent on the genders of the study populations. Three basic figures are included as defaults in AVERT: a value for male-to-female, a value for female-to-male, and a value for male-to-male (represented by subscript *g*). In a scenario wherein the study target population includes female commercial sex workers and their partners are male miners, the initial series of calculations measuring risk to the females uses a male-to-female transmission rate. The second series employs the female-to-male transmission rate to estimate the risk to the miners.

All transmission rates represent a "best estimate" drawn from the literature [5-15] and are restricted to specified types of behavior. The female-male combinations assume vaginal intercourse only, and the male-male combination treats anal intercourse generically, without regard to patterns of receptive or insertive behaviors. In addition to the basic transmission rates, STDs have been shown to enhance the transmissibility of HIV [16-25]. Ulcerative (GUD) and non-ulcerative (Non-GUD) STDs have varying influences, and those effects are incorporated into the model (represented by the subscript *i*). If one or both types of STDs are identified for the study populations, corresponding transmission rates are invoked for the appropriate stratum calculations (see above). Consequently, each of the basic rates without an associated STD also has three additional variants: one in the presence of ulcerative STDs, one for non-ulcerative STDs, and one for a combination of STDs (this value is the same as that used for ulcerative STDs). A total of 12 transmission rates are available in the program (see below). HIV transmission probabilities represent a combination of per contact infectivity and susceptibility, and the probability of HIV transmission is assumed to remain constant over individuals and over time. *The selected values represent time-weighted average figures subsuming the different stages of HIV infection.* We also assume that exposure to HIV is distributed independently of the presence of an STD.

DEFAULT VALUES

The following values constitute the default figures incorporated in AVERT and are used for all calculations. These values were extracted from published literature (see references) and represent distillations that approximate plausible figures. There certainly will be some disagreement about the use of these numbers, but this strategy seems justified to maintain the generalizability of the model. Future versions of the model may incorporate changes consistent with new research findings.

HIV Transmission	Rate
Exposure	
Male-to-Female	0.002
Female-to-Male	0.001
Male-to-Male	0.010

STD Multiplicative Effects	GUD		Non-GUD		GUD & Non-GUD	
Exposure	*Multiplier*	*Rate*	*Multiplier*	*Rate*	*Multiplier*	*Rate*
Male-to-Female	30	0.06	10	0.02	30	0.06
Female-to-Male	60	0.06	10	0.01	60	0.06
Male-to-Male	30	0.30	10	0.10	30	0.30

Condom Effectiveness	0.95

NATURE OF THE MODEL

As with any modeling exercise, the biggest challenge involved with AVERT is accurately estimating the input parameters needed to run the model. The user must find available data from a variety of sources and then derive the most plausible and realistic estimates. Sometimes data are unavailable and/or unpublished. In other instances, data from different sources may conflict with one another. In addition, the validity of published data may be questionable when methodological constraints exist.

AVERT is used to estimate the number of sexually transmitted HIV-1 infections averted due to different types of interventions. If the project in question was a behavioral intervention, then chances are that behavioral data needed to run the model may have been collected as part of the project. If the intervention focused on reducing STDs, then there might be good STD data but no behavioral data. In either case, it is incumbent upon the user to find the best data to run the model. Behavioral data may come from knowledge, attitudes, beliefs, and practices (KABP) surveys conducted with specific target groups, or from behavioral surveillance surveys conducted by the ministry of health and/or other partners. STD and HIV data may come from national or regional surveillance systems, or from isolated studies conducted to gather prevalence and/or incidence data for various risk groups. Although these data may not correspond directly to the populations being modeled, the user must assess the extent to which the data can be used to represent the populations in which they are interested. In some instances users may need to adjust data upward or downward to fit the scenarios they are modeling.

The structure of the AVERT model reflects several constraints that can influence the validity of the model's estimates. Two principal reasons account for this situation. First, keeping the model user-friendly and accessible for available project data requires a certain level of conceptual and procedural simplicity. We attempted to achieve this goal while minimizing the loss of model strength. Second, access to well-documented information is difficult in the best of circumstances.

The most prominent limitation in AVERT is its static nature. Two sets of circumstances can be compared to each other but only in static terms. This leads to an inability to (1) account for individuals who became newly infected during the one-year time-frame and who are not removed from the pool of

susceptibles, and (2) address the issue of secondary infections that result from those newly infected persons.

The model's approach for estimating person-to-person transmission is based on HIV transmission probabilities per sexual exposure. Unfortunately, only limited data exist on the per-exposure cofactor effect of different types of STDs on HIV transmission. Most of the published literature on transmission probabilities report on cumulative risk estimates, such as risk ratios or odds ratios. Cumulative risk, however, does not reflect the risk per sex act, since it is the result of cumulative sex acts, of which only a fraction may have occurred in the presence of an STD. Depending on available specific research findings on HIV infectiousness and susceptibility to HIV associated with genital tract infections, future versions of AVERT may incorporate additional stratification of the STD cofactor effect estimates to distinguish between the STD effect on the infectiousness of HIV-infected individuals and the STD effect on the susceptibility of HIV-uninfected individuals.

In its ease of use and specificity to the task at hand, AVERT is similar to the Epi Model developed by Chin & Lwanga [26]. With only a brief introduction, a computer-literate user with some background in epidemiology can learn to operate AVERT within an hour or so. While the AVERT model's reduced number of input parameters makes it more accessible to stakeholders in intervention programs, its estimates on HIV infections averted have to be interpreted and used thoughtfully. Since HIV infections through sexual intercourse are the result of accumulated risk exposures, preventing an infection at one point in time will not ensure that a person remains uninfected in the long term. Especially in populations with high-risk behaviors, the observed behavior changes suggest that the interventions may only postpone the timing of infections rather than prevent infections indefinitely. In such situations, a discounted measure of quality-adjusted life years (QALYs) or disability-adjusted life years (DALYs) gained would be more appropriate to assess the impact of interventions on HIV infections averted among groups with high-risk behaviors. A discounted measure of years of life gained by a particular HIV prevention program would also enable comparisons with other health programs.

The AVERT model cannot address the critical issue of attribution of measured changes to specific HIV prevention programs. This can only be addressed through an adequate study design used for the evaluation of intervention programs.

The AVERT model does provide an analytical tool for properly collected data. Additionally, the model offers a standardized approach with which we can begin to address the critical question of the extent to which preventative measures may have an impact on the reduction of HIV transmission. AVERT also enables program managers to carry out a cost-effectiveness analysis of different intervention combinations that will provide the basis for designing cost-effective prevention measures for specific target populations in defined epidemiological settings.

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